GENETICS AND THE APPLICATION OF VOICE-RELATED BIOMARKERS

M. PEDERSEN & N.H. NASHAAT

Mette Pedersen.

MD, PhD, Ear-Nose-Throat Specialist, Head & Neck surgeon

Fellow of the Royal Society of Medicine UK

Danish Representative Union of European Phoniatricians

The Medical Center, Østergade 18, 1100 Copenhagen, Denmark

e-mail address: m.f.pedersen@dadlnet.dk

Phone: +45 31126184

Member UEP Biomarkers Committee

Neveen Hassan Nashaat

Prof. MD Ear-Nose-Throat Specialist, Head & Neck surgeon

Phoniatrician. Medical Research and Clinical Studies Institute, National Research Centre

Research on Children with Special Needs Department

Cairo, Egypt.

dr.neveennashaat@gmail.com

Member UEP Biomarkers Committee

INTRODUCTION

Pedersen M, Dinnesen A, Mahmood S. **Chapter 4.9 Genetic Background of Voice Disorders and Genetic Perspectives in Voice Treatment**. In: am Zehnhoff-Dinnesen A, Wiskirska-Woźnica B, Neumann K, Nawka T, editors. Phoniatrics I: fundamentals, voice disorders, disorders of language and hearing development. 1st ed. Berlin: Springer; 2020. p. 225-230. (European Manual of Medicine).

In the book Phoniatrics I, a chapter focuses on the genetic background of voice disorders.

18 genetic tissue deviations are described, related to:

Oral mucosa

Vocal fold mucosa

Cartilage

Genetics of Cancer

INTRODUCTION

An example of Vocal fold microstructure genetic disorder is:

Table 4.2 Genetic background of voice disorders

Gene/chromosome/locus	Genetic details/pathophysiology	Illness/syndrome	Voice pathology	Theory
Vocal fold microstructure				
Gene for elastin *ELN* 7q11.23	Protein is tropoelastin, requires two functioning alleles for normal structural development of the vocal fold lamina propria (Watts et al. 2011)	Lack of one normal ELN allele in supravalvular aortic stenosis (SVAS) and Williams syndrome (WS)	Voice abnormal in individuals with SVAS/WS	Heterozygous *ELN* abnormalities possibly influence vocal fold biomechanics negatively (Watts et al. 2008)

INTRODUCTION

Since then we have been interested in looking at the use of voice-related biomarkers in the area of genetic disorders.

At the time when we wrote the chapter in the book Phoniatrics I the measured voices were not focused upon in the literature.

INTRODUCTION

Gisladottir RS, Helgason A, Halldorsson BV, Helgason H, Borsky M, Chien YR, Gudnason J, Gudjonsson SA, Moisik S, Dediu D, Thorleifsson G, Tragante V, Bustamante M, Jonsdottir GA, Stefansdottir L, Rutsdottir G, Magnusson SH, Hardarson M, Ferkingstad E, Halldorsson GH, Rognvaldsson S, Skuladottir A, Ivarsdottir EV, Norddahl G, Thorgeirsson G, Jonsdottir I, Ulfarsson MO, Holm H, Stefansson H, Thorsteinsdottir U, Gudbjartsson DF, Sulem P, Stefansson K. **Sequence variants affecting voice pitch in humans.** Sci Adv. **2023** Jun 9;9(23):eabq2969. doi: 10.1126/sciadv.abq2969. Epub 2023 Jun 9. PMID: 37294764; PMCID: PMC10256171

The major problem:

We as experts were asked to evaluate a breakthrough article where the genetic link to the fundamental frequency of the voice was identified (Washington Post journalist).

In the Icelandic article, a comparison was made between acoustical voice parameters of pitch and genomic analysis of 12,901 Islanders. A connection was found in the ABCC9 genetic variants.

As for the Islandic study it can be questioned whether a small number of acoustic parameters alone can be used in such a huge genetic comparison situation (80 parameters from the free PRAAT Software, against the genomes of the 12901 Islanders).

INTRODUCTION

Lechien JR, Geneid A, Bohlender JE, Cantarella G, Avellaneda JC, Desuter G, et al. Consensus for voice quality assessment in clinical practice: guidelines of the European Laryngological Society and Union of the European Phoniatricians. Eur Arch Otorhinolaryngol. 2023 Dec;280(12):5459-5473. doi: 10.1007/s00405-023-08211-6.

The UEP committee of voice-related biomarkers suggests as a minimum for non-invasive evaluation:

patient complaints, Voice Handicap Index (VHI) - listener's evaluations (GRBAS test) - acoustic parameters - fundamental frequency (F0), jitter, shimmer, harmonics to noise (HNR), -and lastly airflow, maximum phonation time (MPT).

This correlates to the UEP/ELS consensus paper 2023.
This aspect includes, that a combined score will be possible in the future based on computer foundation models.

INTRODUCTION

1 Nashaat NH, Nagwa A Meguid, Ehab Ragaa Abdelraouf, Nivine A Helmy, Ahmed A. Dardir, Vesna Stojanovik, Aly A El-Nofely. Linguistic Phenotype in a Sample of Arabic Speaking Children with Williams and Fragile X Syndromes. Bioscience Res, 2018; 15(2):873-882

2 Pedersen, Mette & Jønsson, Anders & Larsen, Christian. (2021). Genetics and voice production in childhood and adolescence– a review. International Journal of Pediatrics and Adolescent Medicine. 9. 10.1016/j.ijpam.2021.02.005.

We wanted to identify which mesures are employed for both normal and pathological voices in genetic studies

Early studies were e.g. 1. and 2

1 The study examines linguistic abilities in Egyptian children with the before described Williams Syndrome (WS), revealing delays in syntax and spatial language -- compared to Fragile X Syndrome (FXS), WS children have stronger expressive but weaker receptive skills. Cognitive assessments show verbal strengths but visuospatial weaknesses. **The findings stress the need for early voice, language, and social interventions.**

2 The study explores genetics in voice development during childhood and puberty, linking hormonal changes to vocal fold function. Genetic regulation by the hypothalamus impacts voice changes, with research suggesting voice analysis can aid in diagnosing genetic disorders**. Integrating genetics and advanced voice analysis may improve treatments for multi-handicap syndromes**.

PERSPECTIVES

The Table presents the setup for the search at the Royal Society of Medicine, Library, UK, including limitis.

Table 1. Library search

SEARCH 1
GENETIC studies that include MEASUREMENT of the normal voice:
• pitch and vowel acoustics
• other voice measures
• vocal fold measures
SEARCH 2
Focus on the GENETIC studies that include pathological voice MEASUREMENTS
• pitch and vowel acoustics
• other voice measures
• vocal fold measures
Limits for both searches:
• Last 5 years (2019-2024)
• All languages
• Human studies only
• All studies and publication types

Table 1: Presents the setup for the search at the Royal Society of Medicine, Library, UK, including limits.

To measure voices in genetic especially multihandicaped clients area is new, and many authors of articles especially in genetic neurology have commented that their study is the first on the voice-related measure aspect.

ALL LIBRARY RESULTS OF NORMALS

Di Y, Mefford J, Rahmani E, Wang J, Ravi V, Gorla A, et al. Genetic association analysis of human median voice pitch identifies a common locus for tonal and non-tonal languages. Commun. Biol. 2024 May 7;7(1). doi: 10.1038/s42003-024-06198-2.

This study identifies and confirms a common genetic variant (rs11046212-T in ABCC9) influencing voice pitch in both tonal (Mandarin) and non-tonal (Icelandic) languages. Meta-analysis confirms shared genetic effects on pitch, independent of language structure and mood. The fndings advance understanding of voice genetics and its clinical applications.

The study confirms the connection between fundamental frequency and genetic variant rs11046212-T in ABCC9

PERSPECTIVES

Luchesi LC, Cavalcanti JC, Lucci TK, David VF, Otta E, Monticelli PF. Zygosity Effects on Human Voice: Fundamental Frequency Analysis of Brazilian Twins' Speech. Twin Res Hum Genet. 2024 Aug;27(4-5):215-222. doi: 10.1017/thg.2024.33

This study examines the genetic influence on voice pitch by analyzing fundamental frequency (F0) in Brazilian monozygotic (MZ) and dizygotic (DZ) twins.
Results show **that MZ twins have greater similarity in F0 measures than DZ twins, indicating a genetic effect**.
However, environmental and linguistic factors also play a role, particularly in pitch variability. The findings highlight both genetic and non-genetic influences on voice characteristics.

PERSPECTIVES

1 Mohd Khairuddin KA, Ahmad K, Proehoeman SC, Mohd Ibrahim H, Yan Y. Preliminary Findings of Vocal Fold Vibratory Characteristics of Singers Analyzed by Laryngeal High-Speed Videoendoscopy. J Voice. 2024 Jun 19:S0892-1997(24)00173-5. doi: 10.1016/j.jvoice.2024.06.001.

2 Baum D. Singer's voice quality: genetic or environmental influences? Sci J Lander Coll Arts Sci. 2023;16(2):58–64. Available from https://touroscholar.touro.edu/sjlcas/vol16/iss2/10

1 The study **examines vocal fold vibratory dynamics in singers versus normal speakers** using laryngeal high-speed videoendoscopy (LHSV). Male singers showed higher fundamental frequency (F0GAW) and more stable vocal fold vibrations than normal speakers, while female singers had lower jitterGAW. Nyquist plots revealed male singers had more regular vocal fold vibrations.

2 The study explores whether a singer's voice quality is primarily influenced by genetics or environmental factors. It examines anatomical and physiological aspects of the vocal mechanism, hereditary transmission of vocal traits, and external influences such as climate, altitude, and diet. Findings suggest that while **genetic factors contribute to vocal similarities within families**, environmental elements like training, nutrition, and surroundings significantly shape vocal performance also. The research highlights the complex interplay between innate traits and external conditions in developing a singer's voice.

The research highlights the complex interplay between innate traits and external conditions in developing a singer's voice.

PERSPECTIVES

Zhang S, Zhao J, Guo Z, Jones JA, Liu P, Liu H. The Association Between Genetic Variation in *FOXP2* and Sensorimotor Control of Speech Production. Front Neurosci. 2018 Sep 20;12:666. doi: 10.3389/fnins.2018.00666.

The study investigates the role of the FOXP2 gene in speech motor control by analyzing how genetic variation affects vocal pitch regulation. A specific FOXP2 variant (rs6980093) was linked to differences in compensatory vocal responses and brain activity when processing pitch feedback errors. Individuals with the GG genotype showed smaller vocal adjustments and stronger neural responses in frontal and temporal brain regions, suggesting a shift toward feedforward control of speech. **These findings highlight the genetic influence on auditory-motor integration in voice production.**

The study brings forward the viewpoint of genes related to lower and higher brain activity and voice.

PERSPECTIVES

de Miguel-Luken MJ, Chaves-Conde M, Carnero A. A genetic view of laryngeal cancer heterogeneity. Cell Cycle. 2016 May 2;15(9):1202-12. doi: 10.1080/15384101.2016.1156275.

The study explores the genetic heterogeneity of laryngeal cancer, emphasizing molecular biomarkers and therapeutic advancements. Despite increased molecular knowledge, patient survival rates remain stagnant over the past 30 years. Genetic susceptibility, chromosomal alterations, and mutations in key oncogenes (e.g., TP53, NOTCH1, EGFR) contribute to tumor progression**.**
Biomarkers and targeted therapies, such as inhibitors for NOTCH, EGFR, and DNA damage repair, could improve treatment outcomes. Future strategies should integrate molecular diagnostics to enhance patient-specific therapeutic approaches. In the literature on genetics and laryngeal cancer heterogeneity, voice-related biomarkers were not found.

ALL LIBRARY STUDIES ON VOICE-RELATED BIOMARKERS and PATHOLOGY OF GENES

The next tables summarize the genetics studies on pathology identified in the search that included voice measurements.

First by year and then by genetic relation.

These studies are described concerning the previously outlined voice-related biomarkers:
VHI, GRBAS test, acoustical parameters of F0, jitter, shimmer, HNR (or NHR), and MPT.

The measures are used in the papers but typically only one is addressed in each specific study.

PERSPECTIVES(PATHOLOGY)

- Table 2. **Overview of yearly papers on genetic disorders that include the voice analysis up to middle 2024, around 50 studies, grouping was difficult**

2024
Saft C, et al. Speech Biomarkers in Huntington's Disease: A Longitudinal Follow-Up Study in Premanifest Mutation Carriers.
Kao TH et al, Oral Diadochokinetic Markers of X-linked Dystonia-Parkinsonism
2023
Cala F, Artificial Intelligence Procedure for the Screening of Genetic Syndromes Based on Voice Characteristics
O'Brien ARW et al, Prevalence of Voice and Swallow Problems in Individuals Living with Sickle Cell Disease
Semmler, M et al, Influence of Reduced Saliva Production on Phonation in Patients with Ectodermal Dysplasia
Pelka F et al, Mechanical Parameters Based on High-Speed Videoendoscopy of the Vocal Folds in Patients with Ectodermal Dysplasia
Frasseneti I et al, Quantitative Acoustical Analysis of Genetic Syndromes in the Number Listing Task. Biomedical Signal Processing and Control
Friedman L et al, Atypical Vocal Quality in Women with the FMR1 Premutation: an Indicator of Impaired Sensorimotor Control
Jacinto-Scudeiro LA et al, Dysarthria in Hereditary Spastic Paraplegia Type 4

2022
Riad R et al, Predicting Clinical Scores in Huntington's Disease: a Lightweight Speech Test
Cordella C et al, Acoustic and Kinematic Assessment of Motor Speech Impairment in Patients with Suspected Four-Repeat Tauopathies
Hseu AF et al, Laryngeal Pathologies in Dysphonic Children with Down Syndrome,
Singh R, Connecting Human Voice Profiling to Genomics: A Predictive Algorithm for Linking Speech Phenotypes to Genetic Microdeletion Syndromes
Andrade BMR et al, Impact of Semioccluded Vocal Tract Exercises and Choral Singing on Quality of Life in Subjects with Congenital GH Deficiency
Sacconi S et al, Facial and Vocal Recognition as a Decision Support Tool for Neuromuscular Diseases: The FACENMD Project

Perspectives (pathology)

- Table 2. **Overview of yearly papers on genetic disorders that include the voice analysis up to middle 2024 around 50 studies. grouping was difficult**

2021
Lowell S.Y et al, Clinical Features of Essential Voice Tremor and Associations with Tremor Severity and Response to Octanoic Acid Treatment
Kosztyła-Hojna B et al, Phoniatric, Audiological, Orodental and Speech Problems in a Boy with Cardio-Facio-Cutaneous Syndrome Type 3 (CFC 3) Due to a Pathogenic Variant in MAP2K1 – Case Study
Neves PCR et al, Perfil Vocal de Indivíduos 46, XX com Hiperplasia Adrenal Congênita
Hidalgo-De la Guía I et al, Acoustic Analysis of Phonation in Children with Smith–Magenis Syndrome.
Hidalgo-De la Guía et al, Specificities of Phonation Biomechanics in Down Syndrome children, Biomedical Signal Processing and Control
2020
Song SA. et al, Progressive Decline in Voice and Voice-Related Quality of Life in X-Linked Dystonia Parkinsonism
Krishnamurthy R et al, Aerodynamic and Acoustic Characteristics of Voice in Children with Down syndrome-A Systematic Review
Moya-Mendez ME et al, Auditory-Perceptual Voice and Speech Evaluation in ATP1A3 positive patients
Carraro L et al, Phenotypic Characterization of a Cohort of Patients Affected by Laryngeal Dystonia: A Monocentric Study
Sobuś et al, Humoral Influence of Repeated Lineage-Negative Stem/Progenitor Cell Administration on Articulatory Functions in ALS Patients

2019
Pebbili GK et al, Laryngeal Aerodynamic Analysis of Glottal Valving in Children with Down Syndrome
Bartier S et al, Pharyngo-Laryngeal Involvement in Systemic Amyloidosis with Cardiac Involvement: a Prospective Observational Study.
Ali L et al, Automated Detection of Parkinson's Disease Based on Multiple Types of Sustained Phonations Using Linear Discriminant Analysis and Genetically Optimized Neural Network
Kleim K et al, Objective Evaluation Criteria for Diagnosis of Spasmodic Dysphonia
Spencer KA et al, Dysarthria Profiles in Adults With Hereditary Ataxia
Khodadoust M et al, Speech Difficulties in Joubert Syndrome
Sebastián-Lázaro D et al, Voz y Habla de los Niños con Síndrome de Deleción de 22q11
Nevler N et al, Validated Automatic Speech Biomarkers in Primary Progressive Aphasia
2018
Ebert B et al, Congenital and Iatrogenic Laryngeal and Vcal Abnormalities in Patients with 22q11
Jackowska J et al, Thyroplasty in Unilateral Vocal Fold Paresis with Coexisting Hereditary Hemorrhagic Telangiectasia: A Case Report
Vogel AP et al, Coordination and Timing Deficits in Speech and Swallowing in Autosomal Recessive Spastic Ataxia of Charlevoix–Saguenay
Konstantopoulos K et al, Quantification of Dysarthrophonia in a Cypriot Family with Autosomal Recessive Hereditary Spastic Paraplegia Associated with a Homozygous SPG11 Mutation
Szklanny K et al, Voice Alterations in Patients with Morquio A Syndrome
Demopoulos, C et al, Abnormal Speech Motor Control in Individuals with 16p11
2017
Vogel AP et al, Voice in Friedreich Ataxia
Hidalgo I. et al, Biomechanical Description of Phonation in Children Affected by Williams Syndrome
Vogel AP et al, Speech and Swallowing Abnormalities in Adults with POLG Associated Ataxia (POLG-A), Mitochondrion
Poujois A et al, Dystonic Dysarthria in Wilson Disease: Efficacy of Zolpidem. Frontiers in Neurology
Hintze JM et al, Spasmodic Dysphonia: A Review. Part 1: Pathogenic Factors.
Balasubramaniam RK et al, Voice Mutation During Adolescence in Mangalore, India: Implications for the Assessment and Management of Mutational Voice Disorders
Turner SJ et al, Dysarthria and Broader Motor Speech Deficits in Dravet syndrome
Wolf AE et al, Phonoarticulation in Spinocerebellar Ataxia type 3
Montazeri M et al, Voice Acoustic and Perceptual Features in Lipoid Proteinosis: A Report of Two Cases

Neurodegenerative Movement Disorders

Huntington’s Disease

2024 - Saft C, et al. *Speech Biomarkers in Huntington’s Disease: A Longitudinal Follow-Up Study in Premanifest Mutation Carriers.*

2022 - Riad R et al. *Predicting Clinical Scores in Huntington’s Disease: a Lightweight Speech Test.*

X-Linked Dystonia-Parkinsonism

2024 - Kao TH et al. *Oral Diadochokinetic Markers of X-linked Dystonia-Parkinsonism.*

2020 - Song SA et al. *Progressive Decline in Voice and Voice-Related Quality of Life in X-Linked Dystonia Parkinsonism.*

Hereditary Ataxias & Spinocerebellar Ataxias

2019 - Spencer KA et al. *Dysarthria Profiles in Adults With Hereditary Ataxia.*

2018 - Vogel AP et al. *Coordination and Timing Deficits in Speech and Swallowing in Autosomal Recessive Spastic Ataxia of Charlevoix–Saguenay.*

2018 - Konstantopoulos K et al. *Quantification of Dysarthrophonia in a Cypriot Family with Autosomal Recessive Hereditary Spastic Paraplegia (SPG11 Mutation).*

2017 - Vogel AP et al. *Voice in Friedreich Ataxia.*

2017 - Wolf AE et al. *Phonoarticulation in Spinocerebellar Ataxia type 3.*

Parkinson's Disease

2019 - Ali L et al. *Automated Detection of Parkinson's Disease Based on* ***Multiple Types of Sustained Phonations*** *Using Linear Discriminant Analysis and Genetically Optimized Neural Network*

Wilson's Disease

2017 - Poujois A et al. *Dystonic Dysarthria in Wilson Disease: Efficacy of Zolpidem.*

Amyotrophic Lateral Sclerosis (ALS)

2020 - Sobuś et al. *Humoral Influence of Repeated Lineage-Negative Stem/Progenitor Cell Administration on Articulatory Functions in ALS Patients.*

Primary Progressive Aphasia

2019 - Nevler N et al. *Validated Automatic Speech Biomarkers in Primary Progressive Aphasia.*

Essential Voice Tremor

2021 - Lowell S.Y et al. *Clinical Features of Essential Voice Tremor and Associations with Tremor Severity and Response to Octanoic Acid Treatment.*

Chromosomal and Microdeletion Syndromes

Down Syndrome

2022 - Hseu AF et al. *Laryngeal Pathologies in Dysphonic Children with Down Syndrome.*

2020 - Krishnamurthy R et al. *Aerodynamic and Acoustic Characteristics of Voice in Children with Down Syndrome - A Systematic Review.*

2019 - Pebbili GK et al. *Laryngeal Aerodynamic Analysis of Glottal Valving in Children with Down Syndrome.*

2021 - Hidalgo-De la Guía et al. *Specificities of Phonation Biomechanics in Down Syndrome Children.*

22q11.2 Deletion Syndrome

2019 - Sebastián-Lázaro D et al. *Voz y Habla de los Niños con Síndrome de Deleción de 22q11.*

2018 - Ebert B et al. *Congenital and Iatrogenic Laryngeal and Vocal Abnormalities in Patients with 22q11*

Smith-Magenis Syndrome

2021 - Hidalgo-De la Guía I et al. *Acoustic Analysis of Phonation in Children with Smith–Magenis Syndrome.*

Williams Syndrome

2017 - Hidalgo I et al. *Biomechanical Description of Phonation in Children Affected by Williams Syndrome.*

16p11 Microdeletion Syndrome

2018 - Demopoulos C et al. *Abnormal Speech Motor Control in Individuals with 16p11*

Dravet Syndrome

2017 - Turner SJ et al. *Dysarthria and Broader Motor Speech Deficits in Dravet Syndrome.*

Neuromuscular and Dystrophic Disorders

Hereditary Spastic Paraplegia

2023 - Jacinto-Scudeiro LA et al. *Dysarthria in Hereditary Spastic Paraplegia Type 4.*

2018 - Konstantopoulos K et al. *Quantification of Dysarthrophonia in Autosomal Recessive Hereditary Spastic Paraplegia (SPG11 Mutation).*

Congenital Growth Deficiency

2022 - Andrade BMR et al. *Impact of Semioccluded Vocal Tract Exercises and Choral Singing on Quality of Life in Subjects with Congenital GH Deficiency*

Neuromuscular Diseases (General)

2022 - Sacconi S et al. *Facial and Vocal Recognition as a Decision Support Tool for Neuromuscular Diseases: The FACENMD Project.*

Spasmodic Dysphonia & Laryngeal Dystonia

2019 - Kleim K et al. *Objective Evaluation Criteria for Diagnosis of Spasmodic Dysphonia.*

2019 - Carraro L et al. *Phenotypic Characterization of a Cohort of Patients Affected by Laryngeal Dystonia: A Monocentric Study.*

2017 - Hintze JM et al. *Spasmodic Dysphonia: A Review. Part 1: Pathogenic Factors.*

Ectodermal Dysplasia

2023 - Semmler M et al. *Influence of Reduced Saliva Production on Phonation in Patients with Ectodermal Dysplasia.*

2023 - Pelka F et al. *Mechanical Parameters Based on High-Speed Videoendoscopy of the Vocal Folds in Patients with Ectodermal Dysplasia*

Lipoid Proteinosis

2017 - Montazeri M et al. *Voice Acoustic and Perceptual Features in Lipoid Proteinosis: A Report of Two Cases.*

Cardio-Facio-Cutaneous Syndrome (MAP2K1)

2021 - Kosztyła-Hojna B et al. *Phoniatric, Audiological, Orodental, and Speech Problems in a Boy with Cardio-Facio-Cutaneous Syndrome Type 3 (CFC 3).*

Morquio A Syndrome

2018 - Szklanny K et al. *Voice Alterations in Patients with Morquio A Syndrome*

Joubert Syndrome

2019 - Khodadoust M et al. *Speech Difficulties in Joubert Syndrome.*

ATP1A3 Mutation Syndromes

2020 - Moya-Mendez ME et al. *Auditory-Perceptual Voice and Speech Evaluation in ATP1A3 Positive Patien*

Other Genetic Syndromes & Voice Studies (very much relevant for grouping and genetic treatment)

2023 - Cala F. *Artificial Intelligence Procedure for the Screening of Genetic Syndromes Based on Voice Characteristics.*

2023 - Singh R. *Connecting Human Voice Profiling to Genomics: A Predictive Algorithm for Linking Speech Phenotypes to Genetic Microdeletion Syndromes.*

2023 - Frasseneti I et al. *Quantitative Acoustical Analysis of Genetic Syndromes in the Number Listing Task.*

2023 - Friedman L et al. *Atypical Vocal Quality in Women with the FMR1 Premutation: an Indicator of Impaired Sensorimotor Control.*

2023 - O'Brien ARW et al. *Prevalence of Voice and Swallow Problems in Individuals Living with Sickle Cell Disease.*

PERSPECTIVES (PATHOLOGY)

at least one voice-related biomarker

VHI:	6
GRBAS:	10
F0:	20
Jitter, shimmer:	8
HNR/NHR:	6
MPT:	6
Machine Learning:	5

VHI 6, GRBAS 10, F0 20, Jitter, Shimmer 8, HNR/NHR 6. MPT 6**,**
Machine Learning 5

DISCUSSION

Voice-related biomarkers are essential for personalizing approaches for genetic disorders.

The existing research on genetic disorders and voice varies widely, with voice-related biomarkers often studied in isolation.

A more comprehensive approach, integrating multiple aspects of voice analysis with voice related biomarkers as a minimum, would provide greater accuracy and effectiveness for genetic understanding and therapy.

DISCUSSION

The understanding of genetic pathology and exceptional individuals is expanding.

In gene-related cancer diagnostics, voice-related biomarkers may play a crucial role in conducting randomized controlled trials for diagnosis, treatment, and prognosis.

CONCLUSION

With the support of librarians from the Royal Society of Medicine, UK, we have reviewed papers in the last years (-2024) on genetics focusing on suggested non-invasive biomarkers
(VHI, GRBAS test, acoustic measures of F0, jitter, shimmer, HNR, and MPT).

While these biomarkers are utilized, they are typically studied in isolation, with F0 being the most commonly analyzed. Many authors note that their research represents the first instance of applying voice parameters to genetic syndromes.

The genetic basis of voice in healthy individuals has been explored, particularly with the identification of F0 variations linked to ABCC9 genetic variants, later confirmed.

The future integration of voice-related biomarkers represents a major paradigm shift, enhancing prognostic capabilities for individuals, normal and with genetic disabilities, including those experiencing atypical child development.

Thank you for listening.

Akknowledgement:

Great thanks to Vigga Girelli Meiner for helping with the Powerpoint presentation